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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/615,914	07/10/2003	Richard J. Jibb	D-21350	9560

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EXAMINER	
LEUNG, RICHARD L	

ART UNIT	PAPER NUMBER
3744	

DATE MAILED: 08/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/615,914	Applicant(s) JIBB, RICHARD J.
	Examiner Richard L. Leung	Art Unit 3744

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 July 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10 July 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baker (US-5816313) in view of Gamble et al. (US-5848532). Baker discloses a method for providing refrigeration to a refrigeration load comprising condensing a working fluid in condenser 24, passing the condensed working fluid into an evaporator 11 comprising a wick 16 that is described as porous in column 8, line 38, and which inherently has a surface. On column 5, lines 9-10 it is disclosed that said working fluid is liquefied and supercooled by condenser 24, which is understood as being equivalent to subcooling said working fluid prior to entering said evaporator 11. A refrigeration load 8 is provided to said evaporator 11, and said condensed working fluid is flowed onto the surface of wick 16 and subsequently evaporated from said wick 16 and withdrawn from said evaporator 11 to provide refrigeration to the refrigeration load 8 and to generate a capillary pumping force. Said condensed working fluid is passed to said evaporator 11 at least in part by the capillary pumping force from the evaporation of said working fluid from said wick 16. It is also revealed that the condensed working fluid may be passed to the evaporator in part by gravitational force, as understood from the

liquid level indicated in FIG. 1a and described in column 5, lines 24-27. It is further disclosed that said working fluid is passed from a reservoir 38 to said evaporator 11. Although it is inherent that said condenser 24 cools said working fluid to condense and supercool said working fluid, Baker fails to clearly disclose that refrigeration is generated to condense said working fluid, that said refrigeration is generated using a cryocooler, or that said working fluid comprises nitrogen. Gamble et al. teach a cooling system comprising a cryocooler 13 with heat exchanger 12, which condenses a refrigerant fluid such as nitrogen (column 2, line 53-55), said condensed refrigerant fluid used to provide refrigeration to a refrigeration load 14. It would have been obvious to one of ordinary skill in the art to use nitrogen as taught by Gamble et al. in the refrigeration method disclosed by Baker because nitrogen is a known, suitable refrigerant in applications requiring very low temperatures, and it would have been obvious to use the cryocooler taught by Gamble et al. to condense the working fluid because said cryocooler is capable of reaching cryogenic temperatures, which is necessary in applications wherein a working fluid liquefies at very low temperatures.

3. Claims 7, 8, and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baker (US-5816313) in view of Gamble et al. (US-5848532) as applied to claim 1 above, and further in view of Vary (US-3490718). The combination of Baker and Gamble et al., as already described above, demonstrates a method of providing refrigeration comprising using a cryocooler to condense a working fluid which is subsequently passed to a wick-type

evaporator, wherein evaporation of said working fluid cools a refrigeration load and generates a capillary pumping force. The combination fails to disclose that the porous wick of said evaporator comprises metal, specifically foam metal, or that there is a plurality of pores each having a diameter of less than 0.5 mm. Vary teaches a capillary radiator comprising a wick material composed of foam metal having a plurality of pores of sizes that can range from 0.8 inch to a few microns (column 5, lines 45-54). It is understood that a few microns would be less than 0.5 mm. It would have been obvious to one of ordinary skill in the art to have used in the wick-type evaporated demonstrated in the combination of Baker and Gamble et al. the foam metal wick taught by Vary because Vary teaches that such a wick has tremendous advantages for providing capillary suspension and transmission of heat transfer fluids (column 5, lines 70-73).

4. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Baker (US-5816313) in view of Gamble et al. (US-5848532) as applied to claim 1 above, and further in view of Liao et al. (US-6169852 B1). The combination of Baker and Gamble et al., as already described above, demonstrates a method of providing refrigeration comprising using a cryocooler to condense a working fluid which is subsequently passed to a wick-type evaporator, wherein evaporation of said working fluid cools a refrigeration load and generates a capillary pumping force. The combination fails to disclose that said evaporator is a plate-fin heat exchanger comprising a plurality of fins and that heat from the refrigeration load is provided through the fins to the wick. Liao et al. teach an evaporator comprising a porous wick 17 in contact with a plurality of fins 19. Heat flows from

a heat source 3 through said fins 19 to said porous wick 17. See column 3, lines 24-37. It would have been obvious to one of ordinary skill in the art to have included in the wick-type evaporator demonstrated in the combination of Baker and Gamble et al. the fin and wick arrangement taught by Liao et al. to transfer heat from said refrigeration load to the porous wick because in addition to providing an effective heat transfer contact surface, the fins would inherently define a grooved space through which vaporized fluid may flow (column 2, lines 12-18).

5. Claim 11 and 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baker (US-5816313) in view of Gamble et al. (US-5848532) and Stark (US-6116040). Baker discloses a method for providing refrigeration to a refrigeration load comprising condensing a working fluid in condenser 24, passing the condensed working fluid into an evaporator 11 comprising a wick 16 that is described as porous in column 8, line 38, and which inherently has a surface. On column 5, lines 9-10 it is disclosed that said working fluid is liquefied and supercooled by condenser 24, which is understood as being equivalent to subcooling said working fluid prior to entering said evaporator 11. A refrigeration load 8 is provided to said evaporator 11, and said condensed working fluid is flowed onto the surface of wick 16 and subsequently evaporated from said wick 16 and withdrawn from said evaporator 11 to provide refrigeration to the refrigeration load 8 and to generate a capillary pumping force. Said condensed working fluid is passed to said evaporator 11 at least in part by the capillary pumping force from the evaporation of said working fluid from said wick 16. It is

further disclosed that said working fluid is passed from a reservoir 38 to said evaporator 11. Although it is inherent that said condenser 24 cools said working fluid to condense and supercool said working fluid, Baker fails to clearly disclose that refrigeration is generated to condense said working fluid, that said refrigeration is generated using a cryocooler, or that said working fluid comprises nitrogen. Gamble et al. teach a cooling system comprising a cryocooler 13 with heat exchanger 12, which condenses a refrigerant fluid such as nitrogen (column 2, line 53-55), said condensed refrigerant fluid used to provide refrigeration to a refrigeration load 14. It would have been obvious to one of ordinary skill in the art to use nitrogen as taught by Gamble et al. in the refrigeration method disclosed by Baker because nitrogen is a known, suitable refrigerant in applications requiring very low temperatures, and it would have been obvious to use the cryocooler taught by Gamble et al. to condense the working fluid because said cryocooler is capable of reaching cryogenic temperatures, which is necessary in applications wherein a working fluid liquefies at very low temperatures. Baker also fails to disclose that said working fluid provides refrigeration to a refrigeration load prior to passing said working fluid to said wick-type evaporator 11. Stark teaches a method and apparatus for cooling the electronic components of a refrigerant system, comprising a condenser 13, evaporator 17 and an intermediate refrigeration load, electronic components 25. Stark teaches that the refrigerant liquid can be drawn from condenser 13 by supply line 36 to said electronic components 25, thereby providing low temperature refrigerant for cooling said electronic components 25, and

subsequently passed through discharge line 39 and evaporator 17. See particularly column 3 and FIG. 2. It would have been obvious to one of ordinary skill in the art to have modified the system disclosed by Baker to have included the arrangement taught by Stark in order to regulate the temperature of any electronic components is the system, for example the control block 44. By doing so, it can be understood that the condensed working fluid provides refrigeration to a refrigeration load (i.e. electronic components) prior to being passed to the evaporator, as required by the claims.

6. Claims 12 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baker (US-5816313) in view of Gamble et al. (US-5848532) and Stark (US-6116040) as applied to claim 11 above, and further in view of Liao et al. (US-6169852 B1). The combination of Baker, Gamble et al., and Stark as already described above, demonstrates a method of providing refrigeration comprising using a cryocooler to condense a working fluid, using said working fluid to cool a refrigeration load and subsequently passing said working fluid to a wick-type evaporator, wherein evaporation of said working fluid generates a capillary pumping force. The combination fails to disclose that said condensed working fluid is evaporated in said evaporator by heat provided by an electric heater or that said evaporator is a plate-fin heat exchanger comprising a plurality of fins and that heat from the electric heater is provided through the fins to the wick. Liao et al. teach an evaporator comprising a porous wick 17 in contact with a plurality of fins 19. Heat flows from a heat block 3, which has an electrical heating element (column 2, lines 30-31), through said fins 19 to said porous wick

17. See column 3, lines 24-37. It would have been obvious to one of ordinary skill in the art to have modified the capillary evaporator in the combination of Baker, Gamble et al., and Stark to have included the electric heating element taught by Liao et al. because such a heating element would ensure proper evaporation of the working fluid which is necessary in maintaining the capillary pumping force used to circulate said working fluid, and it would have been further obvious to have included fin and wick arrangement taught by Liao et al. to transfer heat from said heating element to the porous wick because in addition to providing an effective heat transfer contact surface, the fins would inherently define a grooved space through which vaporized fluid may flow (column 2, lines 12-18).

7. Claims 17, 18, 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baker (US-5816313) in view of Gamble et al. (US-5848532) and Stark (US-6116040) as applied to claim 11 above, and further in view of Vary (US-3490718). The combination of Baker, Gamble et al., and Stark as already described above, demonstrates a method of providing refrigeration comprising using a cryocooler to condense a working fluid, using said working fluid to cool a refrigeration load and subsequently passing said working fluid to a wick-type evaporator, wherein evaporation of said working fluid generates a capillary pumping force. The combination fails to disclose that the porous wick of said evaporator comprises metal, specifically foam metal, or that there is a plurality of pores each having a diameter of less than 0.5 mm. Vary teaches a capillary radiator comprising a wick material composed of foam metal having a plurality of

pores of sizes that can range from 0.8 inch to a few microns (column 5, lines 45-54). It is understood that a few microns would be less than 0.5 mm. It would have been obvious to one of ordinary skill in the art to have used in the wick-type evaporated demonstrated in the combination of Baker, Gamble et al., and Stark the foam metal wick taught by Vary because Vary teaches that such a wick has tremendous advantages for providing capillary suspension and transmission of heat transfer fluids (column 5, lines 70-73).

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US-3638447 Abe 2-1-1972: discloses a refrigeration system wherein working fluid from a condenser is supplied to a plurality of evaporators using capillary means coupled to heating coils.

US-4470450 Bizzell et al. 9-11-1984: discloses a heat transfer loop comprising a condenser, a heat exchanger for subcooling a working fluid, a reservoir, and an evaporator containing a capillary pumping structure.

US-4720981 Helt et al. 1-26-1998: discloses a heat transfer loop wherein refrigerant passes from a condenser to a refrigeration load to cool the refrigeration load and subsequently passes to an evaporator.

US-4957157 Dowdy et al. 9-18-1990: discloses a thermal control loop comprising a condenser for liquefying and subcooling a working fluid, a capillary evaporator for receiving heat from a refrigeration load, and a reservoir for maintaining the pressure of the working fluid.

US-5103897 Cullimore et al. 4-14-1992: discloses a thermal loop comprising condensers, a reservoir, and evaporators containing a wicking material for generating capillary pumping force.

US-5587880 Phillips et al. 12-24-1996: discloses a refrigeration system comprising an evaporator and a condenser wherein the condenser is positioned above the evaporator so that condensed fluid can flow from the condenser to the evaporator because of gravity.

US-5944092 Van Oost 8-31-1999: discloses a capillary pumped heat transfer loop comprising a condenser, a reservoir, and a plurality of evaporators containing porous material for generating capillary pumping pressure.

US-6205812 B1 Acharya et al. 3-27-2001: discloses a system for cooling, liquefying, and/or subcooling a product fluid comprising a pulse tube cryocooler.

US-6374617 B1 Bonaquist et al. 4-23-2002: discloses a sytem for cooling, liquefying, and/or subcooling a product fluid comprising a pulse tube cryocooler.

US-6550530 B1 Bilski 4-22-2003: discloses a heat transfer system comprising a condenser and an evaporator containing a porous wick for providing refrigeration to a heat source coupled with the evaporator.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Richard L. Leung whose telephone number is 703-306-4154. The examiner can normally be reached on Mon-Fri.

10. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Denise L. Esquivel can be reached on 703-308-2597. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

11. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Richard L. Leung
Examiner
Art Unit 3744

rll

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